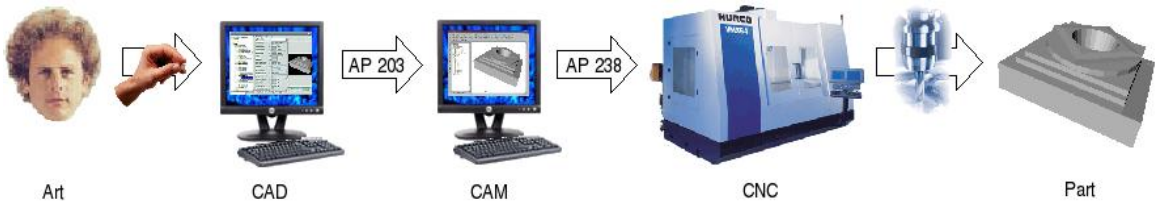
STEP-NC Pilot Demonstration
OMAC STEP-NC Working Group Meeting
3 February 2005
Orlando, Florida USA

17th November 2004



Purpose of This Document

This document describes the scenario for the upcoming OMAC STEP-NC Working Group meeting, 3 February 2005 in Orlando Florida USA. The audience for this document is primarily the group of participants, although it does suggest how STEP-NC will be used in practice and is informative to anyone interested in the technology. Participants should read the scenario to understand what will be expected of them during the demonstration, so there are no surprises.

Demonstration Description

The demonstration will show the use of STEP AP 238 ("STEP-NC") in practice. Each of 4 CAM or CAD/CAM systems will generate STEP AP 238 NC process plans for test part milling, and each of 3 CNCs will simulate the milling. All $4 \times 3 = 12$ combinations will be tested. Changes to the design will be suggested by the audience, and a selected CAD/CAM-CNC combination will show the resulting data flow and machining live.

For the demonstration, the October 29 2004 version of AP 238 will be used, the Draft International Standard (DIS) version completed for the October balloting deadline. Demonstration will be limited to Conformance Class 1 (CC1). STEP data exchange will be through Part 21 physical files.

Test parts will be selected and corresponding AP 203 Edition 1 geometry `.stp` files will be imported into the CAD/CAM systems as the starting point for the demonstration. The test parts are detailed later in this document.

The participants include the following:

- Chen-Han Lee from UGS Corp.;

- John Callen from Gibbs;
- Ming Liu and Waris Jaffrey from The Boeing Company/Wichita;
- David Odendahl from Boeing/Tulsa;
- Sid Venkatesh, King Yee and Mauro Costas from Boeing/Seattle;
- Carol Tierney and John Witco of General Dynamics Land Systems;
- Martin Hardwick from STEP Tools Inc.; and
- Fred Proctor from NIST.

Participants from Dassault Systemes, CNC Software Inc., Parametric Technologies Inc., Siemens AG and GE Fanuc may also be included. The target CAM or CAD/CAM systems include the following:

- UGS's NX;
- Dassault's Catia V5;
- Gibbs' GibbsCAM;
- CNC Software's Mastercam;

The target CNC systems include the following:

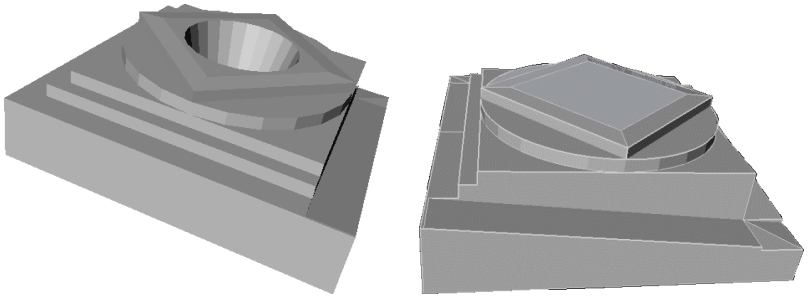
- Siemens' 840D;
- GE Fanuc's 18i; and
- GE Fanuc's 30i.

Test Parts

Two test parts have been selected: the National Aerospace Standard (NAS) 979 "circle diamond square" part with a conical central pocket suitable for testing 5-axis machining (CDS-5), and a 3-axis version without the conical central pocket (CDS-3), both scaled down by half from the original NAS specification. The parts are shown in Figure 1. Reference AP 203 `.stp` files for these two parts are available at `http://www.isd.mel.nist.gov/projects/stepnc`, in the "Data Repository" section.

Scenario

The demonstration is split into two parts, a "canned" demo and a "live" demo. The canned demonstration will exercise STEP-NC for each of the 12 combinations of CAD/CAM-CNC systems possible, as depicted in Figure 2, or some representative subset of combinations if time is limited. For the live demonstration, an audience



(a) (b)

Figure 1: *Test parts: a 5-axis circle-diamond-square part with a conical central pocket (a), and its 3-axis counterpart without the conical feature (b).*

member will select one combination, and make a design change to a test part. The full process planning-machining sequence will be demonstrated for the selected combination. Machining will be simulated using actual CNCs and either software simulation or motor test stands. Videos of cutting tests on real CNCs will be shown, and the resulting machined parts will be displayed. This will show the audience that AP-238 works on real machines, not just the simulations they see at the demonstration.

1. One of the 12 CAD/CAM-CNC combinations possible is selected. Depending upon the CNC selected, either the 3-axis or 5-axis part will be demonstrated.
2. The AP 203 geometry for the test part is imported into the CAM or CAD/CAM system. The process planner works to recognize features, assigns tools and process parameters for each feature, saves the project and exports an AP 238 process plan.
3. `apconform` is run to check that the exported data conforms to STEP AP 238 CC1. Presumably it does, since during preparations in the months leading up to the demonstration the CAD/CAM vendor should have fixed any problems brought to light by `apconform`.
4. The exported AP 238 process plan is imported into the CNC, and milling is run in simulation. The resulting "part" is visually verified against the design.
5. The preceding steps are repeated for each of the remaining combinations.

For the live demonstration, the audience is asked for a design change and CAD/CAM-CNC combination of interest. The previously saved project file is loaded into the CAD/CAM system, rather than the original AP 203, sparing the audience from repeated viewings of the full CAM phase. The suggested change is made, and the sequence follows the canned demonstration.

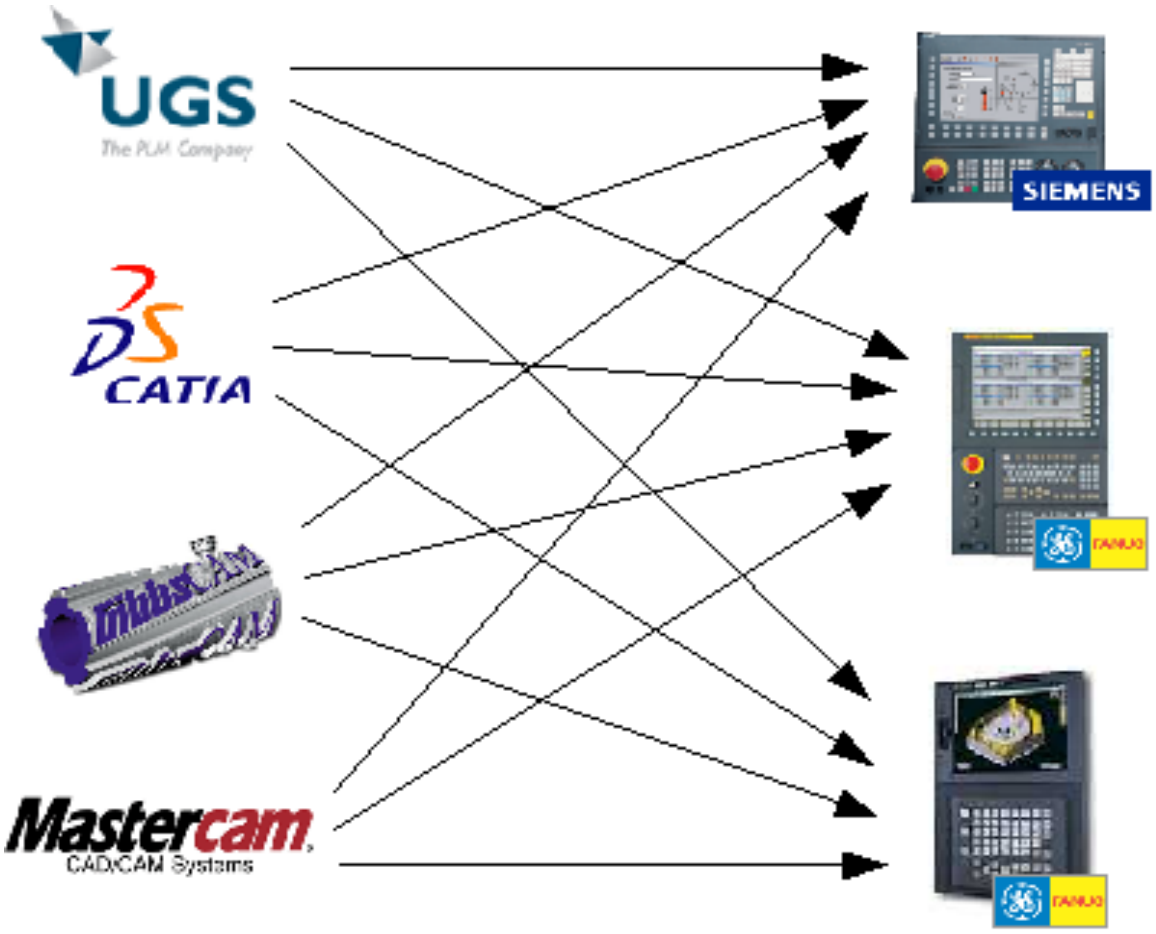


Figure 2: *Combinatorial testing of CAD/CAM and CNC.*